



Road safety effects of frontal brake lights: Evidence from a laboratory and a field study

Rainer Banse^{1,2}, Merlin Monzel^{1,2}, Kristof Keidel^{1,2}, and Wolfgang Schubert²

1 University of Bonn, 2 Bonner Institut für Rechts- und Verkehrspsychologie

Abstract

A frontal brake light that communicates a driver's braking to other road users ahead might be a very simple and economic measure to improve the communication between car drivers and other road users, and thus enhance road safety. In a laboratory study using video clips, the detection speed of braking was assessed in two conditions: In the experimental condition, 50% of cars featured a green frontal brake light. In the control condition, no frontal brake light was visible. In a longitudinal field study, frontal brake lights were mounted in 102 vehicles and tested for three months in the airside zone of the Tegel airport in Berlin. Overall, based on behavior and attitudes in virtual and real traffic, the results strongly suggest that frontal brake lights in vehicles can improve road safety.

Zusammenfassung

Eine Vordere Bremsleuchte, die den Bremsvorgang eines Fahrzeugs vorausfahrenden Verkehrsteilnehmern signalisiert, könnte eine sehr einfache und ökonomische Maßnahme sein, um die Kommunikation des Fahrers mit anderen Verkehrsteilnehmern zu verbessern und so die Verkehrssicherheit zu erhöhen. In einer Laborstudie wurde die Detektionsgeschwindigkeit des Bremsens von KFZ in zwei Bedingungen untersucht: In der Experimentalbedingung waren 50% der Autos mit einer grünen Vorderen Bremsleuchte ausgestattet. In der Kontrollbedingung war keine Vordere Bremsleuchte sichtbar. In einer längsschnittlichen Feldstudie wurde die Vordere Bremsleuchte in 102 Fahrzeugen installiert und im luftseitigen Verkehrsbereich auf dem Flughafen Tegel in Berlin getestet. Insgesamt belegen die Ergebnisse zu Verhalten und Einstellungen im virtuellen und im realen Verkehr, dass Vordere Bremsleuchten an Fahrzeugen die Verkehrssicherheit erhöhen können.



Figure 1. Vehicle with frontal brake light. (Günter Wicker, Ligatur, Copyright BIRVp, 2017).

Introduction

From a frontal view point, pedestrians and other road users have hardly any cues whether a vehicle is braking or not. This information deficit may contribute to many accidents in crossing traffic situations. In 2016, the Federal Statistical Office of Germany [1] recorded 31,793 pedestrians involved in road accidents (30,248 within towns and villages), of which 490 were killed (356 within towns and villages). Compared to 1980, the number of accidents and fatalities have declined considerably, but in recent years the trend has stagnated [2]. Given the high proportion of accidents in towns and villages, improving the communication between car drivers and other road users in general and pedestrians in particular may help to increase road safety. In two studies we investigated whether a frontal brake light could be useful in this respect.

Method

Laboratory study. Participants (N = 31) were instructed to watch a video showing a car approaching. As soon as they detected a braking (28 trials), they pressed a key. If the car did not brake (8 trials), no keypress was required. Speed and deceleration were manipulated. Then followed the experimental condition in which 50% of cars featured a green frontal brake light.

Field study. For a period of three and a half months, 102 vehicles at the Berlin Tegel Airport (TXL) were fitted with frontal brake lights (Fig. 1). Before and after this test period 197 staff members were surveyed on their attitudes about and experience with the frontal brake.

Results and discussion

Laboratory study. The results show that the frontal brake light facilitated the identification of braking considerably ($p < .001$, $d = 4.31$). More importantly, however, in a mixed traffic scenario in which 50% of the cars displayed a frontal brake light when braking, observer's reactions became more conservative when the brake light was absent ($p = .002$, $d = 0.70$). The results

depended on speed and deceleration (Fig. 2). This more cautious reaction pattern can be interpreted as a potential safety effect of the frontal brake light, especially in its absence.

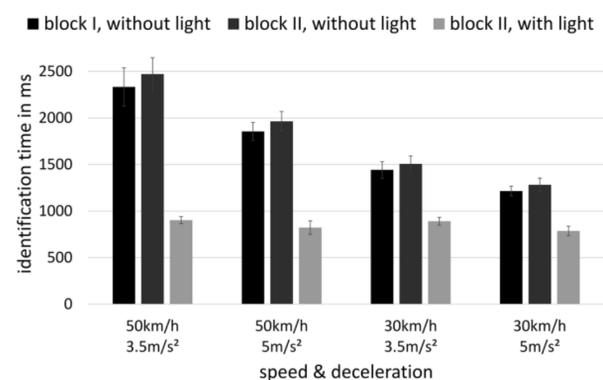


Figure 2. Reaction time until identification of braking as a function of test condition, approach speed and deceleration.

Field study. Participants (N = 197) reported that they have occasionally ($M = 3.32$, $SD = 0.63$) experienced the frontal brake light on the apron, thus providing the necessary precondition for further analyses. Regardless of whether they drove a vehicle with a frontal brake light themselves or encountered one – situations in which the frontal brake light had been useful were reported occasionally to often ($M = 3.25$, $SD = 0.95$) and rarely situations in which it had led to misunderstandings or hazards ($M = 2.09$, $SD = 0.96$; $t(165) = 10.86$, $p < .001$, $d = 0.84$, Fig. 3).

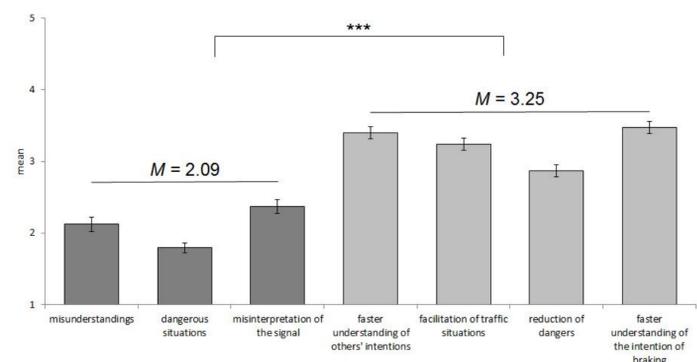


Figure 3. Comparison of positive and negative experiences with the frontal brake light.

Attitudes towards the frontal brake light were already positive at the first measurement ($M = 3.48$, $SD = 0.91$) and further improved during the observation period ($M = 3.70$, $SD = 0.93$; $t(185) = 3.52$, $p = .001$, $d_{RM} = 0.26$), which also became apparent in a voting (Tab. 1). Overall, the results suggest that the vast majority of respondents perceived a positive impact of the frontal brake light on road safety.

Table 1. Voting in favor or against the frontal brake light before and after the 3-months field trial.

		voting t ₂		
		against	in favor	total
voting t ₁	against	16.5 %	10.8 %	27.3 %
	in favor	7.9 %	64.8 %	72.7 %
	total	24.4 %	75.6 %	100 %

Taken together, the results of the two studies strongly suggest that frontal brake lights in vehicles can improve road safety.

References

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Contact

Prof. Dr. Rainer Banse
Kaiser-Karl-Ring 9
53111, Bonn, Germany
e-mail: banse@uni-bonn.de
tel: +49 228 734439